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April 26, 2000

BOX PATENT APPLICATION

Assistant Commissioner for Patents
Washington, D.C. 20231

Re: Application of Hiroyuki MATSUMOTO and Daisuke MAEHARA
PNEUMATIC TIRE AND PROCESS FOR MOUNTING TIRE ONTO VEHICLE
Our Ref. Q57465

Dear Sir:

Attached hereto is the application identified above including 24 sheets of the specification, including the claims and abstract, 6 sheets of formal drawings, an executed Assignment and PTO 1595 form, and an executed Declaration and Power of Attorney.

Priority is claimed from April 27, 1999, and April 13, 2000, based on Japanese Application Nos. 11-119601, and 2000-111842, respectively. The priority documents will be filed at a later date.

A Preliminary Amendment is also enclosed.

The Government filing fee is calculated as follows:

Total claims	10 - 20	=		x	\$18.00	=	\$0.00
Independent claims	2 - 3	=		x	\$78.00	=	\$0.00
Base Fee							\$690.00
TOTAL FILING FEE							\$690.00
Recordation of Assignment							\$40.00
TOTAL FEE							\$730.00

Checks for the statutory filing fee of \$690.00 and Assignment recordation fee of \$40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 and 1.17 and any petitions for extension of time under 37 C.F.R. § 1.136 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A **duplicate** copy of this transmittal letter is attached.

Respectfully submitted,
SUGHRUE, MION, ZINN,
MACPEAK & SEAS, PLLC
Attorneys for Applicant

By: Neil B. Siegel
Neil B. Siegel
Registration No. 25,200

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Hiroynki MATSUMOTO, et al.

Filed: April 26, 2000

For: PNEUMATIC TIRE AND PROCESS FOR MOUNTING TIRE ONTO VEHICLE

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

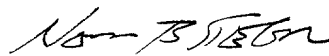
IN THE CLAIMS:

Claim 8, line 1, delete "any one of claims 5-7" and insert --claim 1--.

REMARKS

This amendment is made to avoid the Government Fee for multiple dependency. Entry and consideration of this Amendment is respectfully requested.

Respectfully submitted,



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Date: April 26, 2000

009240-428550

A PNEUMATIC TIRE AND A PROCESS FOR MOUNTING THE TIRE ONTO VEHICLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a pneumatic tire capable of improving a braking performance in a vehicle, particularly a stability
5 of vehicle posture in the sudden braking and a process for mounting such a tire onto the vehicle.

2. Description of Related Art

In order to meet a social demand for more improving safety performances of the vehicle, ABS (antilock braking system or a
10 system for preventing the wheels from locking in the sudden braking) tends to be mounted onto recent vehicles, whereby an action of avoiding danger can be carried out even in the sudden braking.

On the other hand, the braking performance of the vehicle is largely influenced by performance of the tire as a contact point
15 between the road surface and the vehicle, so that various studies have been made for improving the braking performance in the tire. However, it is an actual state that the braking performance inherent to the tire does not reach to a satisfactory level including the stability of vehicle posture in the sudden braking.

20 Nowadays, there is increased a chance of running the vehicle at higher speed under a background that networks of expressways are advanced and the power of the vehicle is increased, so that it is strongly desired to develop tires capable of effectively preventing the change of the vehicle posture even if the sudden
25 braking is carried out during the high-speed running.

SUMMARY OF THE INVENTION

It is, therefore, an object of the invention to provide a high-performance pneumatic tire capable of effectively improving the braking performance of the vehicle, particularly the stability of vehicle posture in the sudden braking suddenly and a process for mounting such a tire onto the vehicle.

According to a first aspect of the invention, there is the provision of in a pneumatic tire comprising a tread portion, a pair of sidewall portions extending inward from both side parts of the tread portion in a radial direction, a bead portion continuously connected to an inner end of the sidewall portion in the radial direction, a carcass reinforcing these portions, a belt arranged on an outer circumferential side of a crown portion of the carcass, and a reinforcing member arranged in a tire zone including at least each of the sidewall portions, preferably a tire zone ranging from the bead portion to the sidewall portion, an improvement wherein a shearing rigidity of the reinforcing member in the circumferential direction, which serves to apply a braking force to the tire, arranged in the same tire at a posture of mounting the tire onto a vehicle is made larger at a first tire zone located at an outside of the vehicle than at a second tire zone located at an inside of the vehicle among the above tire zones.

In such a tire, the shearing rigidity in the circumferential direction in the application of the braking force is higher in the sidewall portion located at the outside of the vehicle than in the sidewall portion located at the inside of the vehicle, so that the shearing deformation amount of the sidewall portion located at the inside of the vehicle becomes larger than that of the sidewall portion located at the outside of the vehicle in the application of the braking

force to the tire and the ground contact area of the tread portion is larger in a part of the tread portion located at the inside of the vehicle than that in a part located at the outside of the vehicle. Thus, right- and left-wheeled tires symmetrically arranged on both side of the vehicle with respect to a center line in a widthwise direction thereof create a force of intending to change into an inward direction based on a difference of frictional force between the tire and the road surface in addition to a difference of rotating radius necessarily caused in the braking of the tire. However, such a force is usually offset by the interaction between the left and right tires, and as a result, the occurrence of yaw moment around the center of gravity in the vehicle is effectively controlled to sufficiently prevent the disorder of the vehicle posture in the braking. The term "yaw moment" used herein means a moment of yawing around a straight line perpendicular to the road surface among the yawings caused in the vehicle running along the road surface.

And also, when such tires are mounted onto the vehicle, the left- and right-wheeled tires symmetrically located on both sides of the vehicle with respect to the center line in the widthwise direction thereof are preferable to be arranged so that the reinforcing members arranged in the first and second tire zones are symmetrical with each other in the left and right tires with respect to the above center line.

In this way, absolute values of the forces changing into the inward direction created in the left- and right-wheeled tires are substantially made equal, whereby the disorder of the vehicle posture in the braking of the vehicle is more effectively prevented.

And also, it is preferable that the reinforcing member arranged in the tire zone is comprised of at least one rubberized cord

reinforcing layer, wherein at least one of the number, width, cord stiffness and end count in the cord reinforcing layer as the reinforcing member arranged in the first tire zone is made larger than the respective one in the cord reinforcing layer as the reinforcing member
5 arranged in the second tire zone in the same tire.

Further, the reinforcing member is preferable to be comprised of plural reinforcing layers, cords of which layers being crossed with each other. Furthermore, at least one reinforcing layer among the reinforcing layers constituting the reinforcing member is preferable to
10 be a turn-up reinforcing layer wound around the bead core from an inside toward an outside in the widthwise direction of the tire.

Moreover, it is more favorable that a cord extending direction of at least one of a reinforcing layer located at an innermost side in the widthwise direction of the tire and a width-widest
15 reinforcing layer among the plural reinforcing layers constituting the reinforcing member is upward to the right in the left-wheeled tire and upward to the left in the right-wheel tire as the reinforcing members arranged in the first and second tire zones viewing a plan of the tire mounted onto the vehicle at its phantom developed state from a
20 ground contact side of the tread portion when a forward running direction of the vehicle is upward. Moreover, when the reinforcing layer aiming at the limitation of the above cord extending direction corresponds to both the reinforcing layer located at the innermost side in the widthwise direction of the tire and the width-widest reinforcing
25 layer, it is preferable to preferentially apply the above cord extending direction to the width-widest reinforcing layer.

Thus, when braking force is applied to the left- and right-wheeled tires, viewing the cord extending directions of the reinforcing

layers in the respective tire zones of each of both the tires, each cord acts to develop a high resistance to tension against the shearing force in the circumferential direction to effectively restrain the shearing deformation in the first tire zone located at the outside of the vehicle, while the cord extending direction in the second tire zone located at the inside of the vehicle is a direction which can not develop a high resistance to tension against the shearing force in the circumferential direction and hence the shearing deformation in the circumferential direction is hardly restrained by the cords of the reinforcing layer.

In the pair of left-and right-wheeled tires, therefore, the second tire zone is largely subjected to the shearing deformation in the circumferential direction rather than the first tire zone, so that the ground contact area of the tread portion in each of both the tires becomes larger in a part located at the inside of the vehicle than that in a part located at the outside thereof as mentioned above, whereby forces changing in the inward direction to be offset each other are created in both the tires.

By the way, it is favorable to apply the above cord extending direction of the reinforcing layer to at least one of the reinforcing layer located at the innermost side of the in the widthwise direction (hereinafter abbreviated as the innermost reinforcing layer) and the width-widest reinforcing layer because the tension in the reinforcing layer is higher at the inner layer side than at the outer layer side and the effect of the cord extending direction is particularly large, and also the acting range becomes wider in the width-wide reinforcing layer and the aforementioned function can be developed in many cords of such a reinforcing layer.

Moreover, in case of arranging one or more turn-up

reinforcing layers wound around the bead core, a portion of the turn-up reinforcing layer located at the innermost side in the widthwise direction of tire is the innermost reinforcing layer. Because, the strength in the turn-up reinforcing layer wound around the bead core is increased by turning to enhance the reinforcing effect. Therefore, when the turn-up reinforcing layer is arranged so as to render into an inner layer, the reinforcing effect is more enhanced by the synergistic action with the above tension increasing effect.

When the reinforcing layer is arranged so as to turn around the bead core, it is preferable that the reinforcing layers are arranged so as to cross cords of these layers with each other in portions other than the turnup portion of the turn-up reinforcing layer turned outward in the widthwise direction of the tire for increasing the reinforcing effect through crossing of the cords.

According to a second aspect of the invention, there is the provision of a process for mounting a pneumatic tire onto a vehicle, said tire comprising a tread portion, a pair of sidewall portions extending inward from both side parts of the tread portion in a radial direction, a bead portion continuously connected to an inner end of the sidewall portion in the radial direction, a carcass reinforcing these portions, a belt arranged on an outer circumferential side of a crown portion of the carcass, and a reinforcing member arranged in a tire zone including at least each of the sidewall portions, preferably a tire zone ranging from the bead portion to the sidewall portion, wherein a shearing rigidity of the reinforcing member in the circumferential direction, which serves to apply a braking force to the tire, arranged in the same tire at a posture of mounting the tire onto a vehicle is made larger at a first tire zone located at an outside of the vehicle

than at a second tire zone located at an inside of the vehicle among the above tire zones, characterized in that the tires having the above construction are mounted onto the vehicle on left and right sides with respect to a center line of the vehicle in a widthwise direction thereof
5 so that the reinforcing members arranged in the first tire zone and second tire zone are symmetrical with each other in both the tires with respect to the above center line.

According to the invention, the stability of vehicle posture in the braking can advantageously be improved because the shearing
10 rigidities in the circumferential direction of the respective tire zones are made substantially symmetrical in the pair of left- and right-wheeled tires with respect to the center line of the vehicle in the widthwise direction to sufficiently equalize forces changing in the inward direction created in the pair of the left- and right-wheeled tires
15 and effectively offset such forces.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein:

Fig. 1 is a diagrammatically section view of an embodiment
20 of the pneumatic tire according to the invention at a state of being mounted onto a rim;

Fig. 2 is a diagrammatically enlarged section view of a main part of the tire shown in Fig. 1;

Figs. 3a and 3b are diagrammatical views illustrating a state
25 of creating a force changing into an inward direction in a left-wheeled tire, respectively;

Fig. 4 is a diagrammatical view illustrating a state of creating yaw moment M when four tires are mounted onto a vehicle;

Fig. 5 is a schematically partial side view of a left-wheeled tire illustrating an influence of a cord extending direction of a reinforcing layer; and

Fig. 6 is a diagrammatically plan view of a phantom developed state of four tires mounted onto a vehicle viewing from a ground contact side of a tread portion when a forward running direction of the vehicle is upward.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Fig. 1 is shown a diagrammatically section view of an embodiment of the pneumatic tire according to the invention at a state of being mounted onto a rim, in which numeral 1 is a tread portion, numerals 2i and 2o sidewall portions extending inward from the both sides of the tread portion 1 in a radial direction, numerals 3i and 3o bead portions continuously connected to inner ends of the sidewall portions 2i, 2o in the radial direction, and numeral 4 a wheel rim seated with the bead portions 3i, 3o.

Moreover, these portions 1, 2, 3 are reinforced between bead cores 6 embedded in the respective bead portions 3i, 3o by a carcass 5 comprised of at least one ply containing organic fiber cords such as polyester cords, nylon cords and the like arranged in the radial direction, while each side portion of the carcass 5 is wound and fixed around the bead core 6 upward in the radial direction. And also, the tread portion 1 is reinforced with a belt 7 superposed on an outer peripheral side of a crown portion of the carcass 5.

For example, as shown in Fig. 1, the belt 7 is comprised of two cross steel cord layers 11 and 12, a wide-width layer or so-called cap member 13 arranged on an outer circumference side and formed by spirally winding an organic fiber cord, and a narrow-width layer or

so-called layer member 14 arranged at each side portion of the cap member 13 on an outer circumference side thereof and formed by spirally winding an organic fiber cord. However, the structure of the belt such as the arranging number of these layers 11-14 and the like
5 can properly be changed in accordance with the use purpose.

In the invention, when the mounting posture of the tire onto the vehicle is specified, a shearing rigidity of the reinforcing member 8o in the circumferential direction, which serves to apply a braking force to the tire, arranged at a first tire zone including the sidewall
10 portion 2o located at the outside of the vehicle (hereinafter abbreviated as first tire zone), in a first tire zone 15o ranging from the bead portion 3o to the sidewall portion 2o in Fig. 1 is made larger than a shearing rigidity of the reinforcing member 8i in the circumferential direction similarly arranged at a second tire zone 15i
15 including the sidewall portion 2i located at the inside of the vehicle (hereinafter abbreviated as second tire zone).

In this case, the above difference of the shearing rigidity in the circumferential direction can be realized, for example, by such a construction that when each of the reinforcing members 8i, 8o
20 arranged in the respective tire zones 15i, 15o is comprised of at least one rubberized cord reinforcing layer (three reinforcing layers 10a-10c in Fig. 1) in the same tire, at least one of the number, width, cord stiffness and end count in the reinforcing layer 10a-10c as the reinforcing member 8o arranged in the first tire zone 15o is made
25 larger than the respective one in the reinforcing layer 10a-10c as the reinforcing member 8i arranged in the second tire zone 15i.

More particularly, as the main part of the tire of Fig. 1 is enlargedly and sectionally shown in Fig. 2, when the reinforcing

member 8o in the first tire zone 15o located at the outside of the vehicle is comprised of two reinforcing layers 10a, 10b arranged between a bead filler 9, which is arranged on an outer peripheral side of the bead core 6 and gradually decreases its thickness outward in the radial direction, and a turnup portion 5a of the carcass 5 and a turn-up reinforcing layer 10c wound around the bead core 6 from an inside of the tire toward an outside thereof in the widthwise direction, the shearing rigidity in the circumferential direction of the reinforcing member 8o at the first tire zone 15o can expectedly be increased as compared with that of the reinforcing member 8i at the second tire zone 15i by decreasing at least one of the number, width, cord stiffness and end count in the reinforcing layer 10a-10c as the reinforcing member 10a-10c as the reinforcing member 8i at the second tire zone 15i located at the inside of the vehicle as compared with that as shown in Fig. 2.

Moreover, the term "width of the reinforcing layer" used herein means a width of the reinforcing layer as measured along the reinforcing layer in a section of the tire (a length in section).

Alternatively, when the bead filler 9 contributing to reinforce the bead portion 3i, 3o of the tire is arranged so as to extend up to the sidewall portion 2i, 2o, the required rigidity difference can be realized by adjusting at least one of rubber hardness, rubber gauge and extending length in the radial direction of the bead filler 9 in place of the above construction or in addition to the above construction.

Now, when each of the reinforcing members 8o, 8i is comprised of plural reinforcing layers 10a-10c as shown in Fig. 2, in order to make more effective the reinforcing action, it is preferable

that at least one reinforcing layer 10c among these layers is a turn-up reinforcing layer wound around the bead core 6 from the inside toward the outside in the widthwise direction of the tire and that the cords are crossed with each other between the reinforcing layers 10a-10c.

5 Moreover, when the cords of the reinforcing layers 10a-10c are crossed with each other as mentioned above, if the cord extending direction of one or more reinforcing layers 10a-10c wound around the bead core 6 obstructs the desired cord crossing between the layers in connection with the arranging number of the reinforcing layers 10a-
10 10c and the like, it is preferable to cross cords in a portion 10c-1 of the turn-up reinforcing layer 10c excluding a turnup portion 10c-2 wound outward in the widthwise direction of the tire with cords of the reinforcing layers 10a, 10b in order to more strongly develop the reinforcing action.

15 When the shearing rigidity in the circumferential direction of the reinforcing member 8o in the first tire zone 15o located at the outside of the vehicle for the input of the braking force is made larger than that of the reinforcing member 8i in the second tire zone 15i located at the inside of the vehicle as mentioned above, viewing the
20 behavior of the left-wheeled tire in the action of the braking force to the tire as shown in Fig. 3a, the first tire zone 15o located at the outside of the vehicle develops a high rigidity to a braking force B_L and slightly deforms in the circumferential direction, while the second tire zone 15i located at the inside of the vehicle is subjected to a large
25 shearing deformation in the circumferential direction, whereby the ground contact shape of the tread portion 1 and hence the ground contact area is made larger at the inner portion of the vehicle than that at the outer portion thereof as shown in Fig. 3b, and the rotating

radius of the tire becomes smaller at the inner side of the vehicle than that at the outer side thereof, and the friction force between the tread portion 1 and the road surface 16 becomes larger at the inner side of the vehicle than that at the outer side thereof. As a result, a force F
5 changing a forward side of the tire toward the inside of the vehicle is created in the tire.

However, such a changing force F is offset by an opposite changing force similarly created in the right-wheeled tire, so that the vehicle can hold a sufficiently stable posture even in the braking.

10 This is especially remarkable when the absolute value of the changing force F is made equal in the left- and right-wheeled tires by rendering the reinforcing members 8o, 8i arranged in the first and second tire zones 15o, 15i into symmetry with respect to the center line of the vehicle in the widthwise direction in the left- and right-
15 wheeled tires symmetrically located at both sides of the vehicle with respect to the center line.

In case of mounting the respective tires having the above construction onto the vehicle as shown by a schematically plan view in Fig. 4, when the braking force is applied to the vehicle, for example,
20 under a condition that front- and rear-wheeled tires located at the left side of the vehicle are existent on a usual paved road surface and front- and rear-wheeled tires located at the right side of the vehicle are existent on a road surface having a low friction force such as a pool, a frozen road or the like, the braking forces B_{FR} , B_{RR} acting to
25 the front- and rear-wheeled tires at the right side become smaller than the braking forces B_{FL} , B_{RL} acting to the front- and rear-wheeled tires at the left side. As a result, even when the vehicle body is usually maintained at a straight running posture, yaw moment M to the left

around the centroidal axis of the vehicle in Fig. 4 is created in accordance with the difference of the braking force between the left- and right-wheeled tires and hence the running direction of the vehicle changes into a left direction shown by a long arrow of a broken line R_1 in Fig. 4.

In the pneumatic tires according to the invention, however, each of these tires creates an inward changing force F in accordance with the magnitude of the braking force applied to such a tire. The inward changing force F is larger in the front- and rear-wheeled tires at the left side than in the front- and rear-wheeled tires at the right side, so that the yaw moment M necessarily created due to the difference between the braking forces applied to the left- and right-wheeled tires is effectively offset by a large inward changing force F created in the left-wheeled tire. As a result, the running direction of the vehicle is sufficiently and stably maintained in the straight running direction shown by a long arrow of a solid line R_2 in Fig. 4.

Moreover, when left- and right-wheeled tires, in which the shearing rigidity in the circumferential direction of the reinforcing member 8o arranged in the first tire zone 15o located at the outside of the vehicle against the action of the braking force to the tire is made larger than that of the reinforcing member 8i arranged in the second tire zone 15i located inside the vehicle, are mounted onto the vehicle so as to render the constructions of the reinforcing members 8i, 8o arranged in the tire zones 15i, 15o in both tires into symmetry with respect to the center line of the vehicle in the widthwise direction, the straight running stability in case of applying the braking force on the vehicle is more improved as mentioned above, so that an excellent straight braking performance can be always obtained though the left-

and right-wheeled tires are located on the road surface of the same condition or different condition.

And also, the desired difference of the shearing rigidity in the circumferential direction between the reinforcing members 8i, 8o arranged in the tire zones 15i, 15o can be attained by specifying the
5 cord extending direction in the reinforcing layers 10a-10c in place of or in addition to the construction mentioned above. In this case, it is preferable that the cord extending direction of at least one of an innermost reinforcing layer and a width-widest reinforcing layer
10 among the reinforcing layers 10a-10c constituting the reinforcing members 8i, 8o arranged in the tire zones 15i, 15o is upward to the right in the left-wheeled tire and upward to the left in the right-wheel tire as the reinforcing members arranged in the first and second tire zones 15o, 15i viewing a plan of the tire mounted onto the vehicle at
15 its phantom developed state from a ground contact side of the tread portion when a forward running direction of the vehicle is upward (see Fig. 6).

In Fig. 5 is shown a side view of the left-wheeled tire (a part thereof) viewed from the outside of the vehicle during the running of
20 the tire, in which a fine line m is a cord extending direction in the reinforcing layer constituting the reinforcing member 8o arranged in the first tire zone 15o and a phantom line n is a cord extending direction in the reinforcing layer constituting the reinforcing member 8i arranged in the second tire zone 15i.

25 When a braking force B_L is applied to the tire bringing about a forward running of the vehicle by anti-clockwise rotation (direction shown by an arrow A in Fig. 5), shearing force S in the circumferential direction is caused in the tire zones 15i, 15o under a relation between

the braking force B_L and inertial force I of the vehicle. With respect to such a shearing force S and hence a main tensile direction resulted from the occurrence of the shearing force S , the cords of the reinforcing layer arranged in the first tire zone 15o (see the fine line m in Fig. 5) develop tension resistance inherent thereto in relation with the cord extending direction and function so as to restrain the shearing deformation in the circumferential direction at the first tire zone 15o, while the cords of the reinforcing layer arranged in the second tire zone 15i (see the phantom line n in Fig. 5) can not effectively develop the supporting function of the shearing force S and hence the relatively large shearing deformation in the circumferential direction is caused in the second tire zone 15i and consequently, the inward changing force similar to the case of Fig. 3 is created. Such an inward changing force is advantageously offset by that created in the right-wheeled tire symmetrically located with respect to the center line of the vehicle in the widthwise direction.

Therefore, the required difference of the shearing rigidity in the circumferential direction can be given to the first and second tire zones 15i, 15o by selecting the cord extending direction in the reinforcing layer as mentioned above.

Moreover, when one or more turn-up reinforcing layers 10c wound around the bead core 6 exist in the reinforcing member 8i, 8o, it is preferable that a portion 10c-1 of the turn-up reinforcing layer located at an innermost side in the widthwise direction of the tire is the innermost reinforcing layer for realizing the above cord extending direction. Thus, the strength is increased by such a turning to enhance the reinforcing effect, and also when the portion 10c-1 of the reinforcing layer 10 is arranged so as to form an inner layer, the

tension is increased to obtain a more further reinforcing effect.

The following examples are given in illustration of the invention and are not intended as limitations thereof.

There are provided pneumatic radial tires for passenger car
5 having a tire size of 235/45ZR17 as a comparative tire and example
tires. In these tires, the ground contact shape and the groove
arrangement comply with Fig. 3, and the constructions of the
reinforcing members 8o, 8i arranged in the first and second tire zones
15o, 15i are shows in Table. 1.

10 A carcass 5 is comprised of two plies each containing
polyester cords of 1000D/2 therein. A belt 7 comprises two cross
steel cord layers 11, 12 each containing steel cords of 1x5 structure
arranged at a cord inclination angle of 22° with respect to an
equatorial plane of the tire, a cap member 13 containing nylon cords
15 of 1260D/2, and a pair of layer members 14 containing the same nylon
cords.

Moreover, the other construction of the tire is substantially
the same as in the usual pneumatic radial tire for passenger car.
(Test Method)

20 The following test is performed with respect to these tires to
evaluate the stability of vehicle posture in sudden braking. And also,
the cornering force (CF) is also measured.

As the stability of vehicle posture in sudden braking, the
yawing magnitude in yaw direction and the sense of stability to the
25 lateral direction until the vehicle is stopped are evaluated together
when each of the tires is mounted onto a test vehicle of rear-wheel-
driving system having a displacement of 2500 cc (a domestic sports
utility passenger car provided with ABS) and run straight forward at a

speed of 120 km/h and suddenly braked while holding a steering wheel at a straightforward running state under a condition of riding two crewmen inclusive of a professional driver. The evaluation results are shown in Table 1. Moreover, the numerical value for the stability in braking in Table 1 is a numerical value when evaluating by ± 10 stages in contrast to Comparative Example which is used as a control tire, in which the larger the numerical value at the side of plus (+), the better the stability.

And also, the cornering force (CF) is measured when each of the tires is assembled onto a rim of 8JJ and inflated under an internal pressure of 240kPa (an internal pressure as measured on the basis of atmospheric pressure) and run on a flat belt type testing machine provided with a safety walk at a speed of 50 km/h under a load of 4410N corresponding to 69.2% of a maximum load capacity (6370N) under a condition that a deviation (slip angle) between the running direction and the rotating surface of the tire is 1° . The measured results are also shown in Table 1. Moreover, the numerical value of the cornering force (CF) in Table 1 is represented by an index on the basis that the comparative tire (CF = 1.77kN) is 100, in which the larger the numerical value, the better the cornering property.

Table 1(a)

		Comparative Example				Example 1				Example 2				
		A	B	C	D	A	B	C	D	A	B	C	D	
Left-wheeled tire	Reinforcing member 8o	Reinforcing layer 10a	50	36	nylon	L42	50	36	nylon	R42	50	36	nylon	R42
		Reinforcing layer 10b	60	36	nylon	R42	60	36	nylon	R42	60	36	nylon	L42
		Reinforcing layer 10c	120	36	nylon	L42	120	36	nylon	R42	120	36	nylon	R42
		10c-1, 10c-2	80, 40				80, 40				80, 40			
	Reinforcing member 8i	Reinforcing layer 10a	50	36	nylon	L42	50	36	nylon	R42	50	36	nylon	R42
Right-wheeled tire	Reinforcing member 8o	Reinforcing layer 10b	60	36	nylon	R42	60	36	nylon	R42	60	36	nylon	L42
		Reinforcing layer 10c	120	36	nylon	L42	120	36	nylon	R42	120	36	nylon	R42
		10c-1, 10c-2	80, 40				80, 40				80, 40			
		Reinforcing layer 10a	50	36	nylon	L42	50	36	nylon	L42	50	36	nylon	L42
	Reinforcing member 8i	Reinforcing layer 10b	60	36	nylon	R42	60	36	nylon	L42	60	36	nylon	R42
Evaluation of tire properties	Cornering property (CF)	Reinforcing layer 10c	120	36	nylon	L42	120	36	nylon	L42	120	36	nylon	L42
		10c-1, 10c-2	80, 40				80, 40				80, 40			
		Stability in braking	control				+ 2				+ 3			
				100				103				104		

(Note) A: width of reinforcing layer (mm), B: end count (cords/50 mm), C: kind of cord, D: extending angle of cord (°) [L42] in D column: 42° upward to the left, [R42] in D column: 42° upward to the right

Table 1(b)

		Example 3				Example 4				Example 5				Example 6			
		A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Left-wheeled tire	Reinforcing member 8o	Reinforcing layer 10a	50	36	nylon	R42	60	36	nylon	R42	60	36	nylon	R42	-	-	R42
		Reinforcing layer 10b	60	36	nylon	L42	70	36	nylon	R42	70	36	nylon	R42	60	34	steel
		Reinforcing layer 10c	120	36	nylon	R42	120	36	nylon	R42	120	36	nylon	R42	120	36	nylon
		10c-1, 10c-2	80,40			80,40				80,40				80,40			
		Reinforcing layer 10a	50	36	nylon	-	30	36	nylon	R42	40	36	nylon	R42	-	-	R42
Right-wheeled tire	Reinforcing member 8i	Reinforcing layer 10b	60	36	nylon	-	40	36	nylon	R42	50	36	nylon	R42	60	36	nylon
		Reinforcing layer 10c	120	36	nylon	R42	100	36	nylon	R42	-	-	-	R42	100	36	nylon
		10c-1, 10c-2	80,40			60,40								60,40			
		Reinforcing layer 10a	50	36	nylon	L42	60	36	nylon	L42	60	36	nylon	L42	-	-	L42
		Reinforcing layer 10b	60	36	nylon	R42	70	36	nylon	L42	70	36	nylon	L42	60	34	steel
Right-wheeled tire		Reinforcing layer 10c	120	36	nylon	L42	120	36	nylon	L42	120	36	nylon	L42	120	36	nylon
		10c-1, 10c-2	80,40			80,40				80,40				80,40			
		Reinforcing layer 10a	50	36	nylon	-	30	36	nylon	L42	40	36	nylon	L42	-	-	L42
		Reinforcing layer 10b	60	36	nylon	-	40	36	nylon	L42	50	36	nylon	L42	60	36	nylon
		Reinforcing layer 10c	120	36	nylon	L42	100	36	nylon	L42	-	-	-	L42	100	36	nylon
Evaluation of tire properties	Cornering property (CF)	10c-1, 10c-2	80,40			60,40								60,40			
	Stability in braking																
			99				102				101				105		
			+ 5				+ 2				+ 1				+ 3		

(Note) A: width of reinforcing layer (mm), B: end count (cords/50 mm), C: kind of cord, D: extending angle of cord (°)
[L42] in D column: 42° upward to the left, [R42] in D column: 42° upward to the right

As seen from the results of Table 1, the tires of Examples 1-6 are excellent in the stability in braking as compared with Comparative Example and the cornering property thereof is equal to or more than that of Comparative Example.

- 5 According to the invention, there can be provided pneumatic tires capable of largely improving the stability of vehicle posture in braking, particularly sudden braking.

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What is claimed is:

1. In a pneumatic tire comprising a tread portion, a pair of sidewall portions extending inward from both side parts of the tread portion in a radial direction, a bead portion continuously connected to an inner end of the sidewall portion in the radial direction, a carcass reinforcing these portions, a belt arranged on an outer circumferential side of a crown portion of the carcass, and a reinforcing member arranged in a tire zone including at least each of the sidewall portions, an improvement wherein a shearing rigidity of the reinforcing member in the circumferential direction, which serves to apply a braking force to the tire, arranged in the same tire at a posture of mounting the tire onto a vehicle is made larger at a first tire zone located at an outside of the vehicle than at a second tire zone located at an inside of the vehicle among the above tire zones.

2. A pneumatic tire according to claim 1, wherein the reinforcing member is arranged in the tire zone ranging from the bead portion to the sidewall portion.

3. A pneumatic tire according to claim 1, wherein left- and right-wheeled tires symmetrically located at both sides of the vehicle with respect to a center line of the vehicle in a widthwise direction are constituted so that the reinforcing members arranged in the first and second tire zones are symmetrical with respect to the center line in both tires.

4. A pneumatic tire according to claim 1, wherein the reinforcing member arranged in the tire zone is comprised of at least one rubberized cord reinforcing layer, and at least one of the number, width, cord stiffness and end count in the cord reinforcing layer as the reinforcing member arranged in the first tire zone is made larger than

the respective one in the cord reinforcing layer as the reinforcing member arranged in the second tire zone in the same tire.

5. A pneumatic tire according to claim 4, wherein the reinforcing member is comprised of plural reinforcing layers, cords of which layers being crossed with each other.

6. A pneumatic tire according to claim 5, wherein at least one of the reinforcing layers constituting the reinforcing member is a turn-up reinforcing layer wound around a bead core embedded in the bead portion from an inside toward outside in a widthwise direction of the tire.

7. A pneumatic tire according to claim 6, wherein the reinforcing layers are arranged so as to cross cords of the reinforcing layers with each other in portions other than a turnup portion of the turn-up reinforcing layer turned outward in the widthwise direction of the tire.

8. A pneumatic tire according to any one of claims 5-7, wherein a cord extending direction of at least one of a reinforcing layer located at an innermost side in the widthwise direction of the tire and a width-widest reinforcing layer among the plural reinforcing layers constituting the reinforcing member is upward to the right in the left-wheeled tire and upward to the left in the right-wheeled tire as the reinforcing members arranged in the first and second tire zones viewing a plan of the tire mounted onto the vehicle at its phantom developed state from a ground contact side of the tread portion when a forward running direction of the vehicle is upward.

9. A pneumatic tire according to claim 8, wherein a portion of the turn-up reinforcing layer located at the innermost side in the widthwise direction of tire is the innermost reinforcing layer.

10. A process for mounting a pneumatic tire onto a vehicle, said tire comprising a tread portion, a pair of sidewall portions extending inward from both side parts of the tread portion in a radial direction, a bead portion continuously connected to an inner end of the sidewall portion in the radial direction, a carcass reinforcing these portions, a belt arranged on an outer circumferential side of a crown portion of the carcass, and a reinforcing member arranged in a tire zone including at least each of the sidewall portions, preferably a tire zone ranging from the bead portion to the sidewall portion, wherein a shearing rigidity of the reinforcing member in the circumferential direction, which serves to apply a braking force to the tire, arranged in the same tire at a posture of mounting the tire onto a vehicle is made larger at a first tire zone located at an outside of the vehicle than at a second tire zone located at an inside of the vehicle among the above tire zones, characterized in that the tires having the above construction are mounted onto the vehicle on left and right sides with respect to a center line of the vehicle in a widthwise direction thereof so that the reinforcing members arranged in the first tire zone and second tire zone are symmetrical with each other in both the tires with respect to the above center line.

ABSTRACT OF DISCLOSURE

A pneumatic tire comprises a tread portion, a pair of sidewall portions, a pair of bead portions, a carcass, a belt, and a reinforcing member arranged in a tire zone including at least the sidewall portion, wherein a shearing rigidity in the circumferential direction of the reinforcing member is made larger at a first tire zone located at an outside of the vehicle than at a second tire zone located at an inside of the vehicle in the same tire at a posture of mounting the tire onto a vehicle.

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FIG. 1

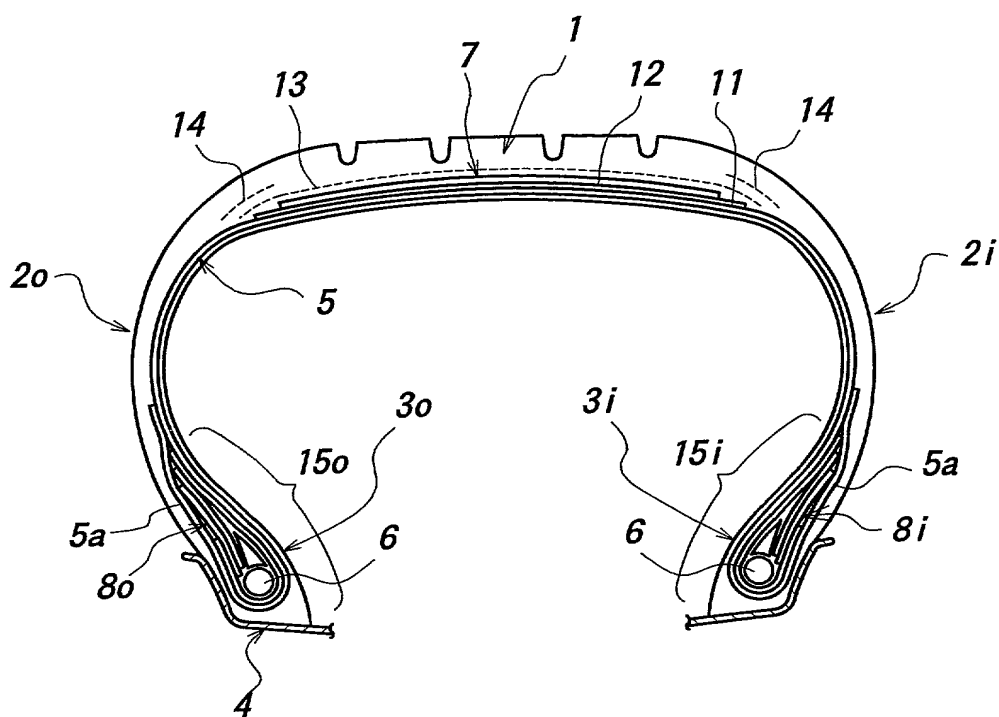


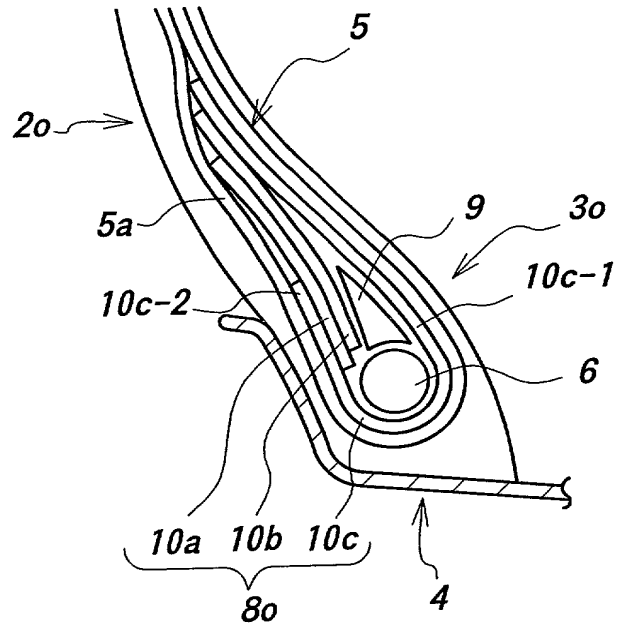
FIG. 2

FIG. 3a

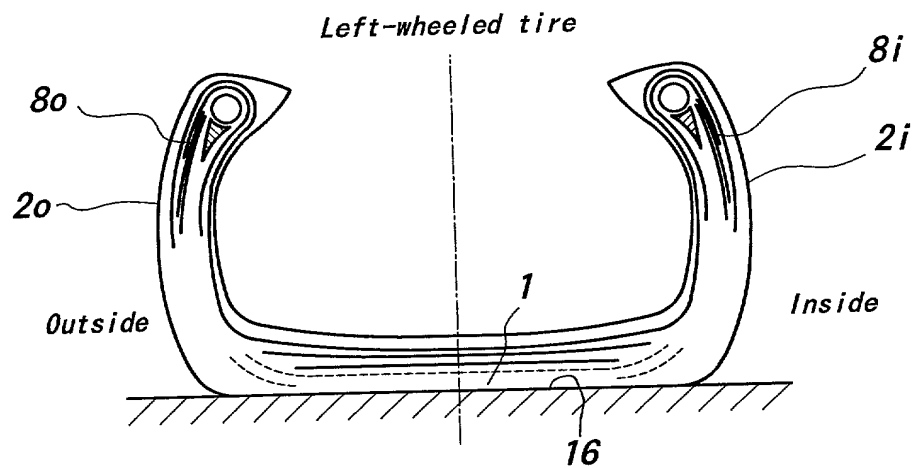


FIG. 3b

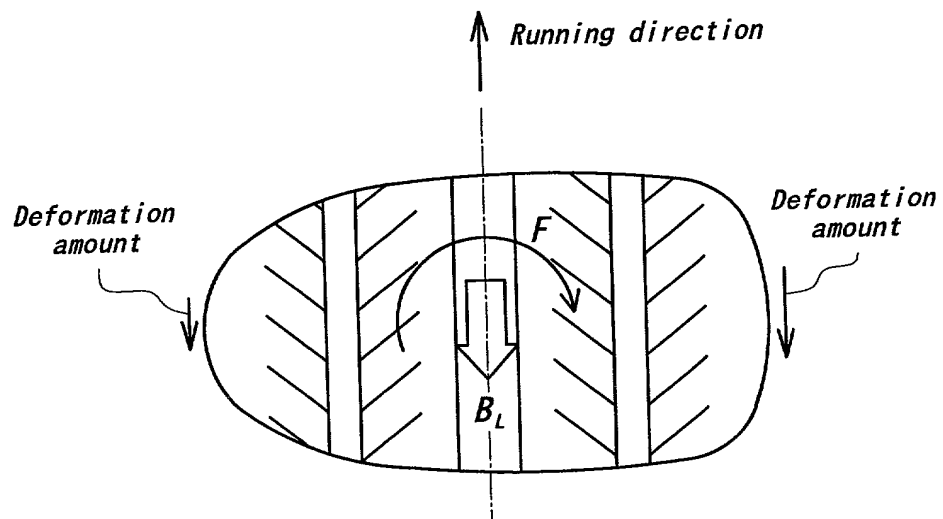


FIG. 4

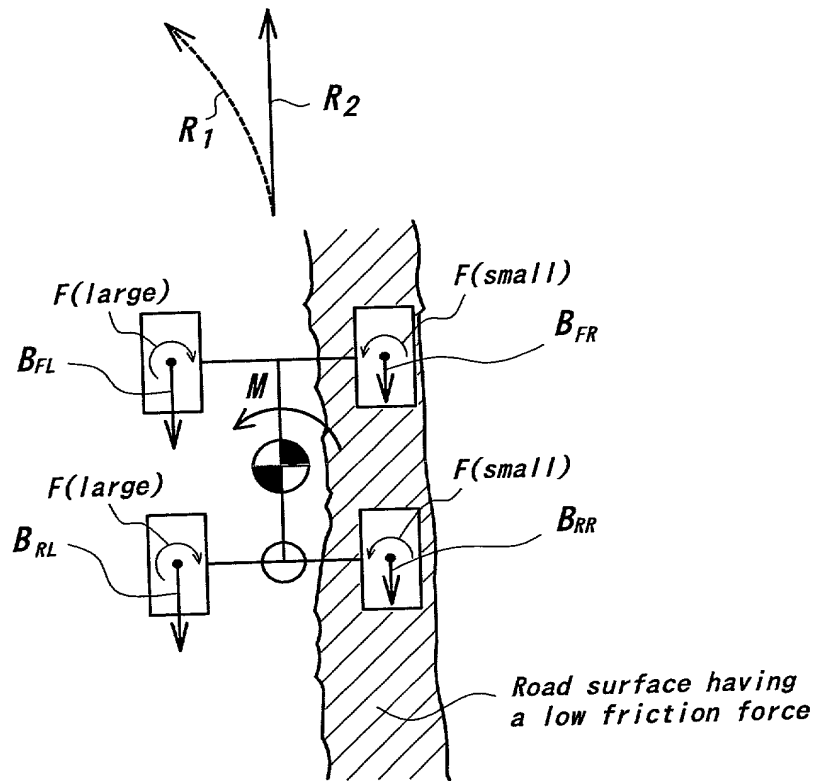


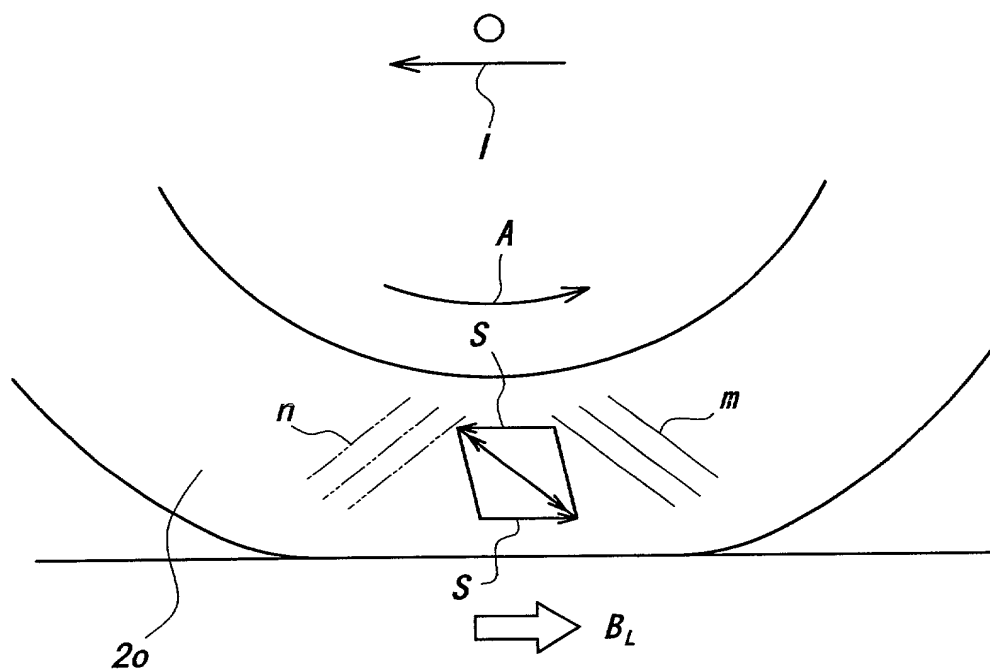
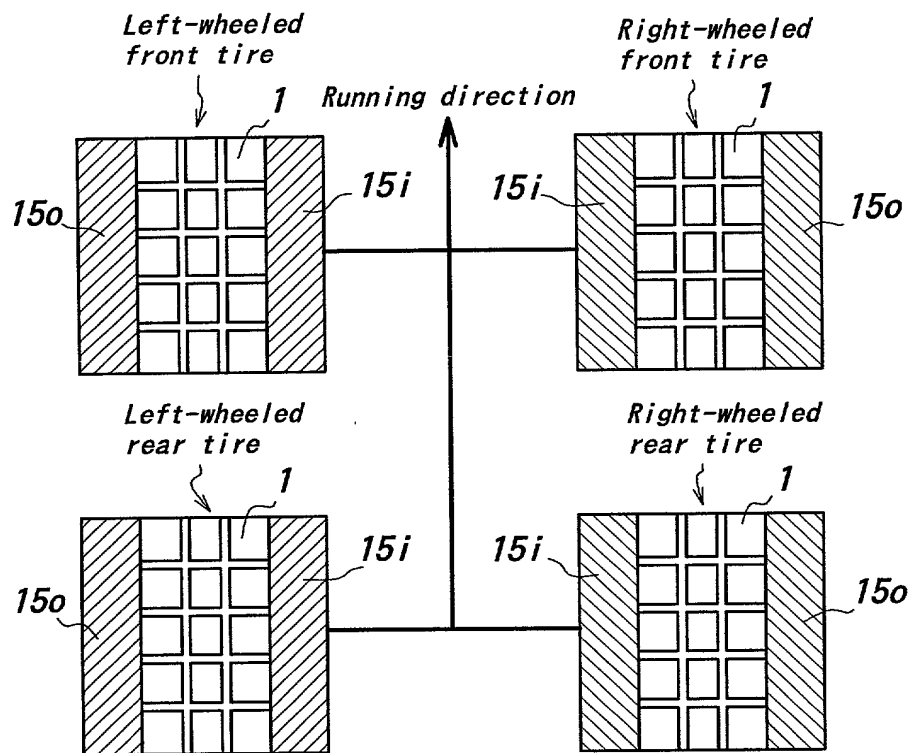
FIG. 5

FIG. 6



Declaration and Power of Attorney for Patent Application

特許出願宣言書

Japanese Language Declaration

私は、下欄に氏名を記載した発明として、以下の通り宣言する：

As a below named inventor, I hereby declare that:

私の住所、郵便の宛先および国籍は、下欄に氏名に続いて記載したとおりであり、

My residence, post office address and citizenship are as stated below next to my name,

名称の発明に関し、請求の範囲に記載した特許を求める主題の本来の、最初にして唯一の発明者である（一人の氏名のみが下欄に記載されている場合）か、もしくは本来の、最初にして共同の発明者である（複数の氏名が下欄に記載されている場合）と信じ、

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

A PNEUMATIC TIRE AND A PROCESS FOR

MOUNTING THE TIRE ONTO VEHICLE

その明細書を
(該当するほうに印を付す)

the specification of which
(check one)

☐ ここに添付する。

☒ is attached hereto.

☐ _____ 日に出願番号

☐ was filed on _____ as

第 _____ 号として提出し、

Application Serial No. _____

_____ 日に補正した。
(該当する場合)

and was amended on _____
(if applicable)

私は、前記のとおり補正した請求の範囲を含む前記明細書の内容を検討し、理解したことを陳述する。

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

私は、連邦規則法典第37部第1章第56条(a)項に従い、本願の審査に所要の情報を開示すべき義務を有することを認める。

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Japanese Language Declaration

私は、合衆国法典第35部第119条、第172条、又は第365条に基づく下記の外国特許出願又は発明者証出願の外国優先権利益を主張し、さらに優先権の主張に係わる基礎出願の出願日前の出願日を有する外国特許出願又は発明者証出願を以下に明記する：

I hereby claim foreign priority benefits under Title 35, United States Code §119, §172 or §365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior foreign applications

先の外国出願

(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願の年月日)	Priority claimed 優先権の主張 <input checked="" type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
11-119,601	Japan	27 April, 1999	<input checked="" type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
2000-111,842	Japan	13 April, 2000	<input checked="" type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願の年月日)	<input type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願の年月日)	<input type="checkbox"/> Yes あり	<input type="checkbox"/> No なし
(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願の年月日)	<input type="checkbox"/> Yes あり	<input type="checkbox"/> No なし

私は、合衆国法典第35部第120条に基づく下記の合衆国特許出願の利益を主張し、本願の請求の範囲各項に記載の主題が合衆国法典第35部第112条第1項に規定の態様で先の合衆国出願に開示されていない限度において、先の出願の出願日と本願の国内出願日又はPCT国際出願日の間に公表された連邦規則法典第37部第1章第56条(a)項に記載の所要の情報を開示すべき義務を有することを認める。

I hereby claim the benefit of Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose any material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.) (出願番号)	(Filing Date) (出願日)	(現況) 特許済み、係属中、放棄済み	(Status) (patented, pending abandoned)
(Application Serial No.) (出願番号)	(Filing Date) (出願日)	(現況) 特許済み、係属中、放棄済み	(Status) (patented, pending abandoned)

私は、ここに自己の知識に基づいて行った陳述がすべて真実であり、自己の有する情報及び信ずるところに従って行った陳述が真実であると信じ、更に故意に虚偽の陳述等を行った場合、合衆国法典第18部第1001条により、罰金もしくは禁固に処せられるか、又はこれらの刑が併科され、又はかかる故意による虚偽の陳述が本願ないし本願に対して付与される特許の有効性を損なうことがあることを認識して、以上の陳述を行ったことを宣言する。

I hereby declare that all statements made herein of my own knowledge are true; and further that all statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Japanese Language Declaration

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選任し、本願の手続きを遂行すること並びにこれに関する一
切の行為を特許商標局に対して行うことを委任する。
(代理人氏名及び登録番号を明記のこと)

POWER OF ATTORNEY: As a named inventor, I hereby
appoint the following attorney(s) and/or agent(s) to
prosecute this application and transact all business in the
Patent and Trademark Office connected therewith (*list
name and registration number*)

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No. 33,276; Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils, Reg. No. 33,102; and Brett S. Sylvester, Reg. No. 32,765, my
attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and
request that all correspondence about the application be addressed to SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC, 2100
Pennsylvania Avenue, N.W., Washington, D.C. 20037-3202.

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(第三又はそれ以降の共同発明者に対しても同様な情報
および署名を提供すること。)

(Supply similar information and signature for third and
subsequent joint inventors.)

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